TEMPERATURE CONTROLLER

3

DX series

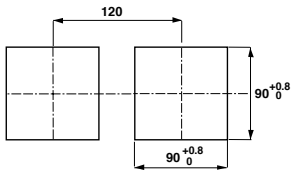
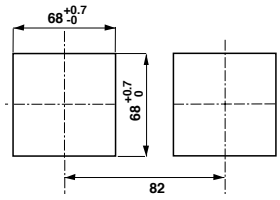
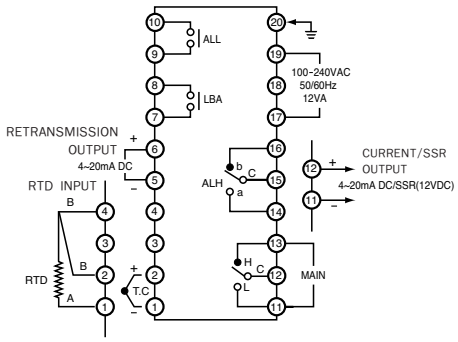
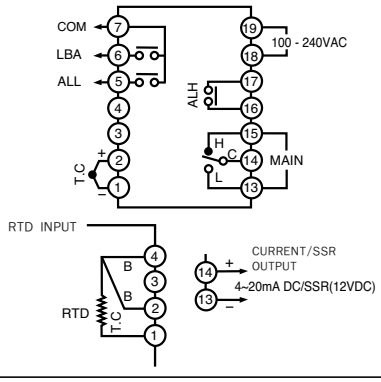
● DX series 60

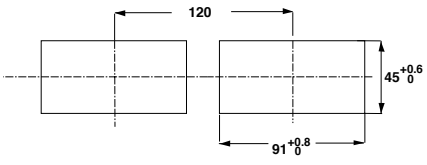
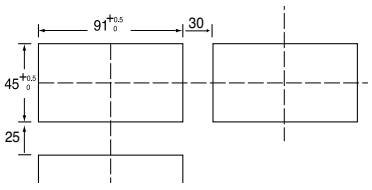
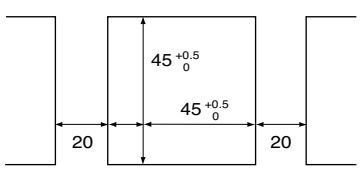
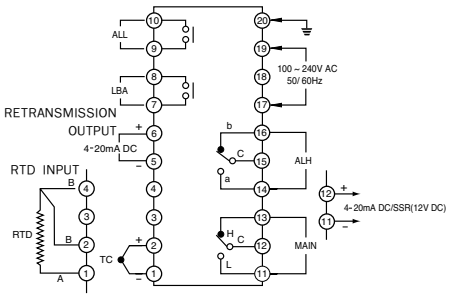
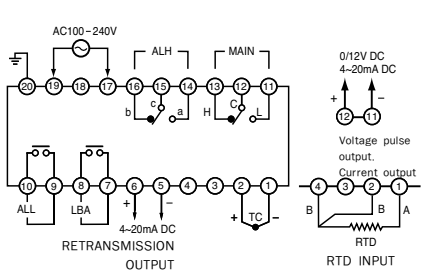
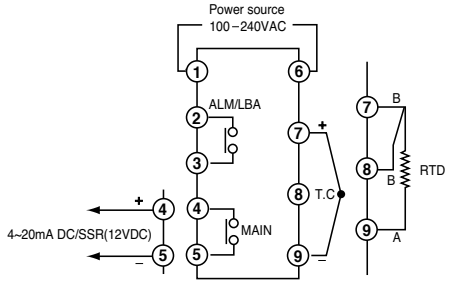
TEMPERATURE CONTROLLER

DX SERIES

HANYOUNG

P.I.D. Control with Auto-tuning Microprocessor based digital temperature/process controllers.

MODEL	DX9	DX7
Appearance		
External dimension	96X96mm(1/4 DIN), mounting depth:100mm	72X72mm, mounting depth:100mm
Input	Thermo couple(K.J.R), R.T.D.(DIN/JIS Pt 100Ω), mV & mA	
Accuracy	[Setting accuracy] T/C : Within±(0.5% of SV+1 digit) or±3℃[6℉] (Whichever is larger) R.Input: 0 ~ 199℃[0~399℉] Within ±5℃[10℉] R.T.D:Within±(0.5% of SV+1 digit) or±1℃[3℉] (Whichever is larger) [Display accuracy] Same as setting accuracy	
Power supply	100~240VAC±10% (50/60Hz)	
Control action	PID (Auto-tuning function), ON/OFF, P · PI · PD	
Control output	Relay contact:AC 250V 1C (NO-5A/NC-3A) (Resistive load) SSR driving: 0/12V DC(Constant voltage pulse)[load resistance more than 800Ω] Current:4-20mA DC[load resistance less than 600Ω]	
Alarm output	Deviation or process setting Relay contact output:AC 250V 0.5A (AL-2, LBA), 3A(AL-1)	
Ambient temperature	0~50℃(32~122℉) ※Ambient humidity:35~85% RH	
Net weight	Approx 320g	Approx 250g
Panel cutout		
Connection		

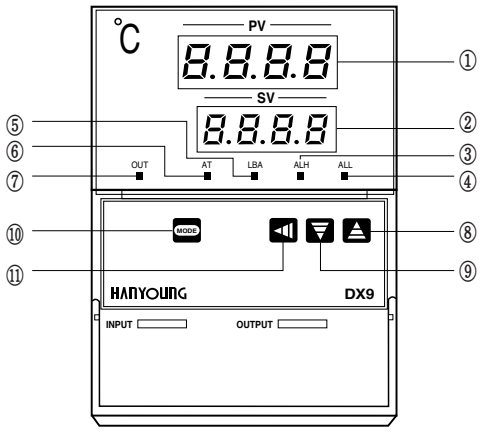
DX2	DX3	DX4
48X96mm(1/8 DIN), mounting depth:100mm	96X48mm(Horizontal), mounting depth:100mm	48X48mm(1/16 DIN), mounting depth:100mm
Thermo couple(K.J.R), R.T.D.(DIN/JIS Pt 100Ω), mV & mA		
[Setting accuracy] T/C : Within±(0.5% of SV+1 digit) or ±3℃[6℉] (Whichever is larger) R.Input: 0 ~ 199℃[0~399℉] Within ±5℃[10℉] R.T.D:Within±(0.5% of SV+1 digit) or 1℃[3℉] (Whichever is larger) [Display accuracy] Same as setting accuracy		
100~240 VAC±10% (50/60Hz)		
PID (Auto-tuning function), ON/OFF, P · PI · PD		
Relay contact:AC 250V 1C (NO-5A/NC-3A) (Resistive load) SSR driving: 0/12V DC(Constant voltage pulse)[load resistance more than 800Ω] Current:4-20mA DC[load resistance less than 600Ω]		Relay contact:AC 250V 5A (Resistive load) SSR driving: 0/12V DC(Constant voltage pulse) [load resistance more than 800Ω] Current:4-20mA DC[load resistance less than 600Ω]
Deviation or process setting Relay contact output:AC 250V 0.5A (AL-2, LBA), 3A(AL-1)		Deviation or process setting, single alarm Relay contact output:AC 250V 3A (Resistive load)
0~50℃(32~122℉) ※Ambient humidity:35~85% RH		
Approx 260g	Approx 250g	Approx 180g
		
		

* Terminal ② and ③ are connected for ALH, ALL and LBA

■ Operation Manual

This maunal primarily describes precautions required in installing and wiring the temperature controller.
We herewith introduce operation of **DX9** for your reference.

■ Functional Description



① Process-value(PV) display unit(Green)
② Set-value(SV) display unit(Red)
③ High alarm(ALH) lamp(Red)
④ Low alarm(ALL) lamp(Red)
⑤ Control loop break alarm(LBA) action indicating lamp(Red)
⑥ Auto-tuning(AT) lamp(Green)
⑦ Control output(OUT) lamp(Green)
⑧ Set-value increment key
⑨ Set-value decrement key
⑩ Mode(SET) key
⑪ Shift key of setting digit

■ Operation

● Description of each parameter

When the power is turned ON, the process-value(PV) display unit shows a process-value and the set-value(SV) display unit shows a set-value. Pressing the MODE key changes the mode and the parameter as shown in the following.

· PV/SV display and SV setting modes

Process value(PV) display unit	Set-value(SV) display unit	Description	Initial-value prior to shipment
Process value	Set-value(SV)	Display process-value. Set-value (SV) can be set. *1	0 or 0.0℃(℉)

*1: Set-value (SV) is a control target. It is settable within the input range.

● Parameter setting mode

Press the MODE key continuously for 5 sec.
(If no key operation is performed for 1 minute, the controller returns to the PV/SV display mode automatically)

Process value(PV) display unit	Name	Description
ALH	High alarm	Displays High alarm set-value.
ALL	Low alarm	Displays Low alarm set-value.
P	Proportional band	Set when proportional control is performed. Control becomes ON/OFF action with P set to "0" or "0.0".
A	Anti-resetwind-up	Prevents overshoot and/or undershoot caused by integral action. Integral action is turned OFF with ARW set to "0".
I	Integral time	Eliminates offset occurring in proportional control. Integral action turns OFF with this action set to "0".
d	Derivative time	Prevents ripples by predicting output change thereby improving control stability. Derivative action turns OFF with this action set to "0".
LbA	Control loop break alarm	Indicates control loop break alarm setting.
C	Proportioning cycle	Displays manipulated output cycle(sec.). Relay contact output: 20 sec. Voltage pulse output : 2 sec.
HYS	Hysteresis(in ON/OFFaction)	Displays hysteresis of Set-Value for main output.
F-r	Full scale limit	Transmitting output signal corresponds to the full scale limit.
U-r	Under scale limit	Transmitting output signal corresponds to the under scale limit.
LoC	Set data lock	Turns the set data lock ON/OFF.

MODE

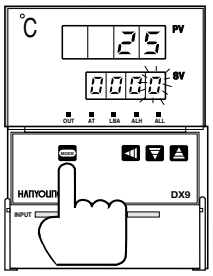
*2
*3

*2/*3(option) · · ·No display when Retransmission output is not attached.

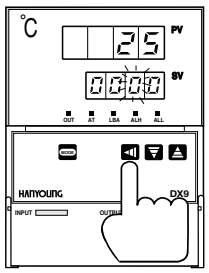
● Each parameter setting

(1) Set-value (SV) setting procedure

The following are examples of setting the set-value(SV) to 70℃.(PV : 25℃)

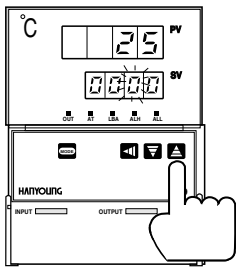


①
Press the MODE key to enter the SV setting mode. The last digit of the set-value(SV) display unit starts to flicker. The digit which flickers is settable.

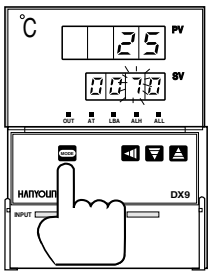


②
Press the ◀ key to shift the digit which flickers up to the two digits. The digit which flickers shifts as follows every time the ◀ key is pressed:

0→0→0→0



③
Press the ▲ key to set "7".
Pressing the ▲ key digit goes up and pressing the ▼ key digit comes down.
・Setting range: Within input range.
When mines(-) sign is set,
Example:
When 70 is changed to -70, shift the digit flickering to the two digits, then press the ▼ key to for the digit coming down in due order of 1→0→-1.

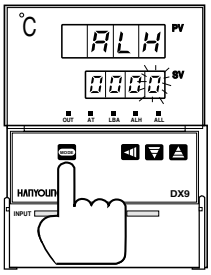


④
After finishing the setting, press the MODE key. All of the set-value digits stop flickering and as a result, the controller returns to the PV/SV display mode.

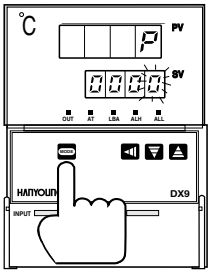
* If the setting ends, pressing the MODE key continuously for 5 sec, again returns the controller to the PV/SV display mode. In addition, if no key operation is performed for 1 minute, the controller is set to the PV/SV display mode automatically.

(2) Each parameter (other than SV) setting procedure

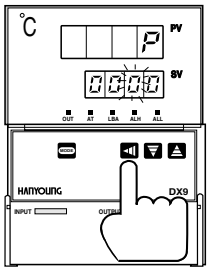
This parameter setting example shows that the proportional band(P) is set to 20℃.



①
Pressing the MODE key continuously for 5 sec. Set the controller to the parameter setting mode (other than SV). Thus, the parameter symbol is shown on the process-valus (PV) display unit. The last digit also flickers. The digit which is flickering is settable.

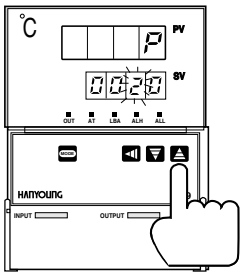


②
Press the MODE key to display the proportional band (P) parameter symbol(P) on the process-value (PV) display unit.

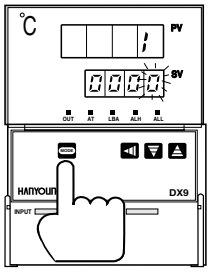


③
Press the ◀ key to shift the digit which flickers up to the two digits.
The digit which flickers shifts as follows every time the ◀ key is pressed.

0→0→0→0



④
Press the ▲ key to set "2".
Pressing the ▲ key, the digit goes up, and pressing the ▼ key, the digit comes down.



⑤
Pressing the MODE key after the setting ends shifts to the next parameter. Repeat the procedures as shown from ② to ⑤ to shift each parameter in turn.

Each parameter symbol and setting range are shown in the following.

Name	Parameter Symbol	Setting Range
High alarm	ALH	-199 to 1770 ℃(℉) or -199.9 to 999.9 ℃(℉)
Low alarm	ALL	-199 to 1770 ℃(℉) or -199.9 to 999.9 ℃(℉)
Proportional band	P	1 to span ℃(℉) or 0.1 to span ℃(℉) (ON/OFF action with P set to "0" or "0.0")
Anti-reset wind-up	A	1 to span ℃(℉) or 0.1 to span ℃(℉) (1 action turns OFF with this action set to "0")
Integral time	I	1 to 3600 sec. (I action turns OFF with I set to "0")
Derivative time	d	1 to 3600 sec. (D action turns OFF with D set to "0")
Control loop break alarm	LbA	1 to 7200 sec. (Setting below "0" cannot be made)
Proportioning cycle	C	1 to 100 sec.
Hysteresis(in ON/OFF action)	HYS	0.1 to 100.0 ℃(℉) or 1 to 100 ℃(℉)
Full scale limit (Option)	F-r	Min. to Max. scale point Instrument.
Under scale limit(Option)	U-r	Min. to Max. scale point Instrument.
Set data lock	LoC	0000:No set data locked. 0001:Only the set-value(SV) is changeable with the set data locked. 0010/0011:Set data locked.

■ Main Functions

● Control loop break alarm (LBA) function

(1) Setting procedure

Usually set the set-value of the LBA to a value of twice the integral time (I).
The LBA can also be set by the auto-tuning(AT) function. In this case, the set-value is automatically set to a value of twice the integral time (I).

(2) Description of operation

LBA function starts to measure time from the moment that the PID Computed Value (Output ON time/cycle) become 0% or 100%, and detects the amount of Process Value change at each LBA setting time, and determines by the amount of change whether LBA is to be ON or OFF.

① When the status at a 100% PID computed value continues beyond the LBA setting time, the LBA turns ON if the measured-value (PV) does not rise by 2℃(℉) or more.
(In direct action, the above alarm turns ON if the measured-value does not fall by 2℃(℉) or more.

② When the status at 0% PID computed value continues beyond the LBA setting time, the LBA turns ON if the measured-value (PV) does not fall by 2℃(℉) or more.
(In direct action, the above alarm turns ON if the measured-value does not rise by 2℃(℉) or more.)

● Causes of activation

The LBA is activated under the following conditions.

① Controlled object trouble····Heater break, no power supply, incorrect wiring, etc.
② Sensor trouble····Sensor disconnected, shorted, etc.
③ Actuator trouble····Burnt relay contact, incorrect wiring, relay contact not closed, etc.
④ Output circuit trouble····Burnt internal relay contact, relay contact not open or closed, etc.
⑤ Input circuit trouble····The measured-value does not change even if input changes, etc.

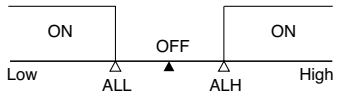
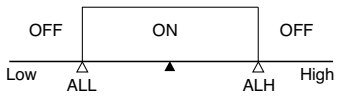
* If causes of the above trouble cannot be identified, check the control system.

● Cautions for control loop break alarm (LBA) function

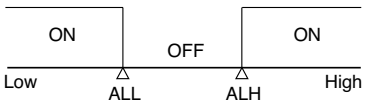
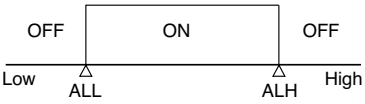
① The LBA function is activated only at the 0% or 100% PID computed value.
Therefore, the time from trouble occurrence till the activation of the LBA function equals the time until PID computed value becomes 0% or 100% plus the LBA setting time.
② The LBA function is activated while the auto-tuning (AT) function is activated.
③ The LBA function is influenced by disturbances (heat sources, etc.) and as a result may be activated even if there is no trouble in the control system.
④ If LBA setting time is too short or does not match the controlled object, the above alarm may not be turned ON and OFF or not be turned ON. In such a case, set the setting of LBA to be slightly longer.

● Alarm function

The action for each alarm becomes as follows :
(▲:Set-value (SV) △:Alarm set-value)

· Deviation alarm High & Low alarm	
Band alarm	

* Band alarm operates only ALH relay.

· Process alarm High & Low alarm	
Band alarm	

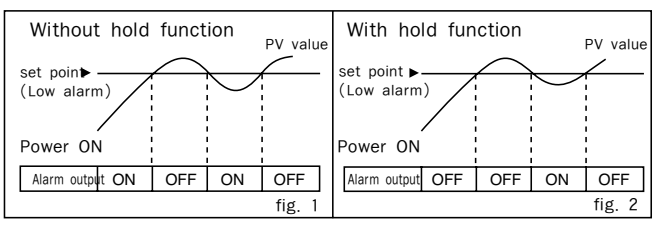
● Overscale and underscale

① If a measured value exceeds the high setting range limit due to upscale, etc., measured-value display starts flashing.
Further, if it exceeds the high input display range limit, the measured-value(PV) display unit flashes overscale display 「" 0000 "」

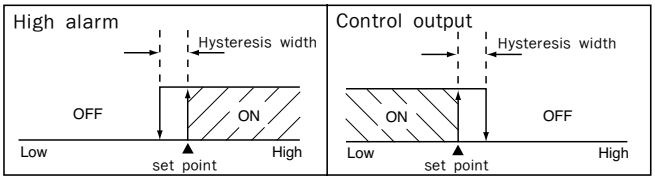
② If a measured-value becomes below the low setting range limit due to downscale, etc., measured-value display starts flashing.
Further, if it becomes below the low input display range limit, the measured-value(PV) display unit flashes under-scale display 「" UUUU "」

● Hold function

· After power is applied, the low alarm is turned on during the temperature rises. If this is not desired, the low alarm can be suspended after power is applied until the temperatre goes out of the alarm setting range by adding the hold function. (Fig. 2)

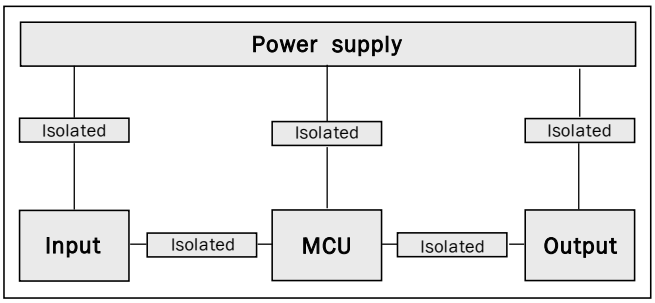


· Freely adjustable hysteresis
Adjustable range : 0-100 or 0.0-100.0℃(℉, or %)



■ Circuit Configuration

As shown in the following diagram, each of the power, input, MCU, and output blocks of the DX9 is mutually isolated.



DX9 circuit configuration

■ Selection of Initial Set Mode

〈CAUTION〉

Do the setting according to the specifications of the controller supplied. If you select wrong input or output, it causes the malfunctions. Set according to the input or output specifications as shown inside of front lid.

(1) Set the Dip switch on the inner PCB to INITIAL set.
NORMAL INITIAL

(2) Turn on the power, then SL1 displays on the Process Value display unit(PV), which is in the state of initial setting.

(3) Push the mode key, then the Parameters will be changed as follows :

SL1 ---------- PV-display Unit
[ ][ ][ ][ ][ ]------- SV-display Unit
(Input mode fixed)

SV-Display unit	Description
0000	Current or Voltage
0001	K(CA)
0010	JIS Pt 100Ω
0011	DIN Pt 100Ω
0100	R(PR)
0101	J(IC)

SL2 ----------PV-display Unit
[ ][ ][ ][ ] -------SV-display Unit

Indicator/Controller selectable

Set	Description
0	Indicator
1	Controller

℃/℉ Selectable

Set	Description
0	℉
1	℃

Decimal mode selectable

Set	Description
0	With decimal mode
1	Without decimal mode

(Output mode fixed)

Set	Description
0	Current output
1	Relay or voltage, Pulse

SL3 ----------PV-display Unit
[ ][ ][ ][ ] -------SV-display Unit

Deviation/Process alarm selectable

Set	Description
0	Deviation Setting
1	Process Setting

Alarm mode selectable

Set	Description
0	Band alarm(ALH)
1	High and Low alarm

Retransmission Output(PV:250 Step): Option

Set	Description
0	With retransmission output
1	Without retransmission output

Hold function of alarm selectable

Set	Description
0	With hold function
1	Without hold function

PV-Display unit	Descriptions	SV-Display unit (Setting range)	Remark
SL4	Decimal point position selection	0 ~ 4	If you want 000.0 set 0002 on SV-display unit
SL5	Input shift value	-100~3200 (-199.9~999.9)	
SL6	Hysteresis of high alarm(ALH)	-100~3200 (-199.9~999.9)	Use for only process alarm
SL7	Upper limit of temperature setting range	-100~3200 (-199.9~999.9)	
SL8	Lower limit of temperature setting range	-100~3200 (-199.9~999.9)	

■ Model and Suffix code (DX Series)

MODEL	SUFFIX CODE	DESCRIPTION	
DX4 DX3 DX2 DX7 DX9	— □ □ □ □ □	48 X 48 mm 96 X 48 mm (Horizontal) 48 X 96 mm (Vertical) 72 X 72 mm 96 X 96 mm	
INPUT (Fixed in order)	K	K(CA)	-50~1,300℃
	J	J(IC)	-50~600℃
	R	R(PR13%)	0~1,700℃
	P	P:DIN Pt 100Ω D:JIS Pt 100Ω	-199~600℃
	V	1~5V DC	0~3,200℃
	C	4~20mA DC	0~3,200℃
CONTROL OUTPUT (Fixed in order)	M	Relay contact	
	C	Current(4~20mA DC)	
	S	SSR drive pulse voltage(0/12V DC)	
	F	Voltage(0~10V DC)	
	N	None(Indicator)	
ALARM	S	Single alarm(Only for DX4)	
	W	Dual alarm(not available for DX4)	
RETRANSMISSION OUTPUT (Option for DX2, DX3 and DX9)	A	4~20mA DC for Process-Value	
	M	0~10mA DC for Process-Value	
	G	0~5V DC for Process-Value	
	V	1~5V DC for Process-Value	
	Q	1~10V DC for Process-Value	
	N	None	
CONTROL ACTION	R	Reverse action for heating control	
	D	Direct action for cooling control	